

REMARKS

Applicants concurrently file herewith a petition (and fee) for one-month extension of time.

Claims 1, 4, 6, 9-13, 15, and 21 are pending in this Application. Applicants have amended claims 1, 6, and 21. No new matter is added.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicants specifically state that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 1, 4, 6, 9-13, 15, and 21 stand rejected under 35 U.S.C. § 112, first paragraph.
Claims 1, 4, 6, 9-13, 15, and 21 stand rejected under 35 U.S.C. § 112, second paragraph.

Claims 1, 2, and 4-21 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Ichinose et al. (US 2004/0007708, hereinafter "Ichinose"). Claims 1, 2, 4-6, 8, 14, 19, and 21 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Itoh et al. (US Patent 6,218,207, hereinafter "Itoh"). Claims 9, 10, 12, and 15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Itoh in view of Ota (US 2003/017098, hereinafter "Ota"). Claims 11 and 13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Itoh in view of Braddock (US Patent 6,989,556).

Applicants respectfully traverse these rejections in the following discussion.

I. THE CLAIMED INVENTION

The claimed invention (e.g., as defined by exemplary claim 1) is directed to a semiconductor layer.

The semiconductor layer includes a first layer including a Ga₂O₃ system single crystal substrate, and a second layer including a nitride surface of said first layer containing oxygen and nitrogen.

In a conventional semiconductor layer, as described in the Background of the present Application, semiconductor layer includes an Al₂O₃ substrate made of Al₂O₃, an AlN layer, which is formed on a surface of the Al₂O₃ substrate, and a GaN growth layer which is formed

on the AlN layer through epitaxial growth (e.g., see Application at page 1, lines 15-19).

By applying the conventional semiconductor layer, the lattice constants of the AlN layer and the GaN growth layer cannot be perfectly made match each other, and thus it is difficult to further enhance crystal quality of the GaN growth layer. In addition, when the conventional semiconductor layer is applied to a light emitting element, crystalline of a luminous layer is degraded, and luminous efficiency is reduced (e.g., see Application at page 2, lines 2-9).

The claimed invention, however, provides a semiconductor layer, in which a first layer including a Ga₂O₃ system single crystal substrate, and a second layer includes a nitride surface of said first layer containing oxygen and nitrogen (e.g., see Application at page 2, line 21 – page 3, line 1).

With this structure, the second layer which has the GaN system compound semiconductor with high crystalline could be obtained without interposing a buffer layer. Hence, when the GaN system epitaxial layer is formed on the second layer, the lattice constants of the second layer and the GaN system epitaxial layer can match each other, and thus the GaN system epitaxial layer having the high crystal quality could be obtained (e.g., see Application at page 12, lines 1-13).

II. THE 35 U.S.C. 112, FIRST PARAGRAPH REJECTION

In rejecting claim 1, 4, 6, 9-13, 15, and 21, the Examiner alleges that the claims are indefinite for failing to particularly point out the invention.

Applicants have amended claims 1, and similarly claims 6 and 21, to recite, “*a second layer comprising a nitride surface of said first layer containing oxygen and nitrogen,*” (emphasis added by Applicants) to define the claimed invention more particularly.

Applicants submit that support for this amendment can be found at least in Application at page 2, line 21 – page 3, line 1, which recites that the second layer is obtained by replacing part of the oxygen atoms of the first layer (i.e., Ga₂O₃ layer) with nitrogen atoms.

Indeed, one with ordinary skill in the art would have known “*a nitride surface of said first layer containing oxygen and nitrogen*,” recited in claims 1, 6, and 21, as replacing part of the oxygen atoms of Ga₂O₃ with nitrogen atoms. Therefore, the specification of the present

Application clearly supports this amendment to claims 1, 6, and 21.

Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

III. THE 35 U.S.C. 112, SECOND PARAGRAPH REJECTION

In rejecting claim 1, 4, 6, 9-13, 15, and 21, the Examiner alleges that the claims are indefinite for failing to particularly point out the invention.

As set forth above in section II, Applicants have amended independent claims 1, 6, and 21 for clarity.

Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

IV. THE PRIOR ART REJECTION

A. The Ichinose Reference

The Examiner alleges that Ichinose anticipates claims 1, 2, and 4-21.

Applicants respectfully submit, however, that the alleged reference does not teach or suggest each and every feature of the claimed invention.

However, in the interest of expediting prosecution, Applicants file herewith the executed Declaration under 37 C.F.R. § 1.132 as evidence that any invention disclosed but not claimed in Ichinose was derived by the co-inventors of the present Application, and thus not an invention “by another.” Therefore, Ichinose is not prior art against the claimed invention under 35 U.S.C. §102(e).

Furthermore, Applicants submit that Ichinose does not teach or suggest, “*a second layer comprising a nitride surface of said first layer containing oxygen and nitrogen,*” (emphasis added by Applicants) as recited in claim 1, and similarly recited in claims 6 and 21.

Indeed, the Examiner does not even allege that Ichinose teaches or suggests this feature of the claimed invention.

Instead, the Examiner states that “(c)laims 1 and 6 will therefore be interpreted as a second layer comprising GaN without oxygen” (Office Action at page 4, lines 5-6).

The Examiner bases the rejection upon paragraphs [0082-0085] of Ichinose and

alleges that the reference teaches the claimed second layer.

Ichinose teaches a light emitting element that has a gallium oxide substrate and a p-n junction on the substrate (Fig. 7). Ichinose, however, in paragraphs [0082-0085], upon which the Examiner based the rejection (or anywhere else, for that matter), is silent about, and fails to teach or suggest, that the second layer includes a nitride surface of said first layer containing oxygen and nitrogen, as recited in claims 1, 6, and 21. Thus, Ichinose fails to satisfy the plain meaning of claim language.

Moreover, Applicants submit that Ichinose does not teach or suggest, “*a third layer comprising a GaN system epitaxial layer grown on the second layer*,” (emphasis added by Applicants) as recited in claim 6.

The Examiner bases the rejection upon paragraphs [0038] – [0096] of Ichinose and alleges that the reference teaches the claimed epitaxial layer. The Examiner, however, is clearly incorrect.

Applicants submit that Ichinose in paragraphs [0038] – [0096], upon which the Examiner based the rejection (or anywhere else, for that matter), is silent about, and fails to teach or suggest, a GaN epitaxial layer, as recited in claim 6.

Indeed, the only place that Ichinose refers to an epitaxial layer is paragraph [0007] of the alleged reference, in which Ichinose teaches a SiC epitaxial layer. SiC is not GaN, which is recited in the claimed invention. Thus, Ichinose fails to satisfy the plain meaning of claim language.

Therefore, Applicants respectfully submit that Ichinose fails to teach or suggest each element of Applicant’s claimed invention. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

B. The Itoh Reference

The Examiner alleges that Itoh anticipates claims 1, 2, 4-6, 8, 14, 19, and 21.

Applicants respectfully submit, however, that the alleged reference does not teach or suggest each and every feature of the claimed invention.

That is, Itoh does not teach or suggest, “*a second layer comprising a nitride surface of said first layer containing oxygen and nitrogen*” (emphasis added by Applicants) as recited in claim 1, and similarly recited in claims 6 and 21.

Indeed, the Examiner does not even allege that Itoh teaches or suggests this feature of the claimed invention.

Instead, the Examiner states that “(c)laims 1 and 6 will therefore be interpreted as a second layer comprising GaN without oxygen” (Office Action at page 4, lines 5-6).

The Examiner bases the rejection upon columns 5-7 of Itoh and alleges that the reference teaches the claimed first layer.

Itoh teaches that the alleged substrate 22 may include insulator single crystals of sapphire, spinel, magnesium oxide, zinc oxide, chromium oxide, lithium niobium oxide, lithium tantalum oxide or lithium gallium oxide, etc. (col. 5, lines 37-48). Itoh, however, in columns 5-7, upon which the Examiner based the rejection (or anywhere else, for that matter), is silent about, and fails to teach or suggest, that the second layer includes a nitride surface of said first layer containing oxygen and nitrogen, as recited in claims 1, 6, and 21. Thus, Itoh fails to satisfy the plain meaning of claim language.

More specifically, Applicants submit that in the claimed invention, the claimed GaON layer is formed between the Ga_2O_3 substrate and the GaN layer, when the substrate is nitrided. However, according to Itoh, the nitriding is implemented after depositing an Al single crystal layer 24 on a sapphire substrate 22, as depicted in Figs. 8A to 8C of Itoh, and as shown in the enclosed Exhibit 1. Therefore, the claimed invention is quite different from (and not taught or suggested by) Itoh.

In addition, referring to FIG. A in the enclosed Exhibit 1, when a device having a structure of the claimed invention is fabricated using Itoh's method, the structure of the device would have been completely different from the structure of the claimed invention. Additionally, the device structure of the claimed invention cannot be fabricated by the alleged method of Itoh. Thus, Itoh fails to teach or suggest the claimed invention.

Moreover, Applicants submit that Itoh does not teach or suggest, “a third layer comprising a GaN system epitaxial layer grown on the second layer,” (emphasis added by Applicants) as recited in claim 6.

The Examiner bases the rejection upon columns 5-7 of Itoh and alleges that the reference teaches the claimed epitaxial layer. The Examiner, however, is clearly incorrect.

Indeed, Itoh teaches that the alleged layer 25 is a metal nitride single crystal layer (column 5, lines 49-51). This is different from, and fails to teach or suggest, “a third layer

comprising a GaN system epitaxial layer grown on the second layer,” (emphasis added by Applicants) as recited in claim 6. Thus, Itoh fails to satisfy the plain meaning of claim language.

Therefore, Applicants respectfully submit that Itoh fails to teach or suggest each element of Applicant’s claimed invention. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

Moreover, in rejecting claims 9, 10, 12, and 15, the Examiner alleges that one of ordinary skill in the art would have combined Itoh with Ota to render obvious the claimed invention.

Applicants respectfully submit, however, that the references would not have been combined as alleged by the Examiner and that, even if combined, the alleged combination of references would not teach or suggest each and every feature of the claimed invention.

Applicants respectfully traverse this rejection, at least because Ota is not cited as remedying the aforementioned deficiencies of Itoh.

Indeed, Ota is merely cited for allegedly disclosing a β -Ga₂O₃. Thus, claims 9, 10, 12, and 15 are allowable for at least the same reasons that the underlying base claims are allowable.

Moreover, Applicants respectfully submit that these references are unrelated and would not have been combined as alleged by the Examiner. Thus, no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicants submit that there is no motivation or suggestion in the references (and thus no predictability for one of ordinary skill in the art) to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicants respectfully submit that one of ordinary skill in the art would not have combined the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Therefore, Applicants respectfully submit that one with ordinary skill in the art would not have combined Itoh with the teachings of Ota, and even if combined, the alleged combination does not teach or suggest (or render obvious) each and every feature of the claimed invention. Therefore, Applicants respectfully request the Examiner to reconsider and

withdraw this rejection.

Moreover, in rejecting claims 11 and 13, the Examiner alleges that one of ordinary skill in the art would have combined Itoh with Braddock to render obvious the claimed invention.

Applicants respectfully submit, however, that the references would not have been combined as alleged by the Examiner and that, even if combined, the alleged combination of references would not teach or suggest each and every feature of the claimed invention.

Applicants respectfully traverse this rejection, at least because Braddock is not cited as remedying the aforementioned deficiencies of Itoh.

Indeed, Braddock is merely cited for allegedly disclosing $(\text{In}_x\text{Ga}_{1-x})_2\text{O}_3$. Thus, claims 11 and 13 are allowable for at least the same reasons that the underlying base claim is allowable.

Moreover, Applicants respectfully submit that these references are unrelated and would not have been combined as alleged by the Examiner. Thus, no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicants submit that there is no motivation or suggestion in the references (and thus no predictability for one of ordinary skill in the art) to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicants respectfully submit that one of ordinary skill in the art would not have combined the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Therefore, Applicants respectfully submit that one with ordinary skill in the art would not have combined Itoh with the teachings of Braddock, and even if combined, the alleged combination does not teach or suggest (or render obvious) each and every feature of the claimed invention. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

V. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicants submit that claims 1, 4, 6, 9-13, 15, and 21, all the claims presently pending in the application, are patentably distinct over the prior art of

Serial No. 10/567,369
Docket No. PKHF-04053US
HIR.201

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record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Date: 03/18/2010

Respectfully Submitted,

Farhad Shir

Farhad Shir, Ph.D.

Registration No. 59,403

Sean M. McGinn, Esq.

Registration No. 34,386

**MCGINN INTELLECTUAL PROPERTY
LAW GROUP, PLLC**
8321 Old Courthouse Road, Suite 200
Vienna, Virginia 22182-3817
(703) 761-4100
Customer No. 21254